WP 4.3. The LOSS Model

Sensitivity of the Long-term Observation-error Survey Series (LOSS) model to variable stock-recruit steepness and stock depletion inputs: A test case using Gulf of Maine haddock

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WP 4.3. The LOSS Model – the purpose

- 2008 GARM Models Meeting Panel recommended that "alternative models should be explored that have both a stronger basis in biology and more explicitly address uncertainty" for stocks whose reference points are currently determined using the relative trend class of model (e.g., AIM).

- Specifically, age structured models which incorporate life history parameters and allow for direct estimated of biological reference points.

  - E.g., Age Structured Production Model (ASPM) (Payne et al. 2005, Brandão and Butterworth 2008)

WP 4.3. The LOSS Model – overview

- The LOSS model is similar to the age-structured production model (ASPM) used by Payne et al. (2005) and Brandão and Butterworth (2008) among others.

- In addition to catch and an observed index of abundance, the model requires five input vectors (vectors held constant for all years):
  - natural mortality-at-age (M)
  - weight-at-age (WAA)
  - maturity-at-age (MAA)
  - single fleet selectivity
  - an index selectivity

- Assumes deterministic recruitment (B-H SR fit)

- Can get direct estimates of F_{MSY}, SSB_{MSY}, terminal F and terminal SSB.

WP 4.3. The LOSS Model – example of Gulf of Maine haddock

- Among GARM stocks whose reference points were previously assessed using the relative trends class of models, GoM haddock it is one of the best "behaved" stocks

  - i.e., there is a strong relationship between the relative F and replacement ratios

- Used preliminary estimates of WAA, MAA and selectivity vectors (may not agree exactly with those used in later VPA runs) and landings and survey time series (1963 to 2006)

- Assessed model sensitivity to variations in the depletion ratio (S1/S0) and SR steepness

  - Evaluated w/respect to:

   - Objective function

    - SSB/SSB_{MSY}

    - F/F_{MSY}

| Age	M	WAA	MAA	Fleet selectivity	Index selectivity
0	0.2	0.001	0.0	0.01	0.5
1	0.2	0.368	0.2	0.10	1.0
2	0.2	0.699	0.6	0.50	1.0
3	0.2	0.996	0.9	1.00	1.0
4	0.2	1.264	1.0	1.00	1.0
5	0.2	1.504	1.0	1.00	1.0
6	0.2	1.720	1.0	1.00	1.0
7	0.2	1.915	1.0	1.00	1.0
8	0.2	2.089	1.0	1.00	1.0
9	0.2	2.247	1.0	1.00	1.0
10	0.2	2.388	1.0	1.00	1.0
11	0.2	2.515	1.0	1.00	1.0
12	0.2	2.630	1.0	1.00	1.0
13	0.2	2.733	1.0	1.00	1.0
14	0.2	2.825	1.0	1.00	1.0
15	0.2	2.908	1.0	1.00	1.0
16	0.2	2.983	1.0	1.00	1.0
17	0.2	3.050	1.0	1.00	1.0
18	0.2	3.111	1.0	1.00	1.0
19	0.2	3.165	1.0	1.00	1.0

WP 4.3. The LOSS Model - results

- Results – no clear "best fit", but highly variable implications for stock status.

  - (run 61 = best fit, run 1 = highest SSB, run 8 = lowest SSB)
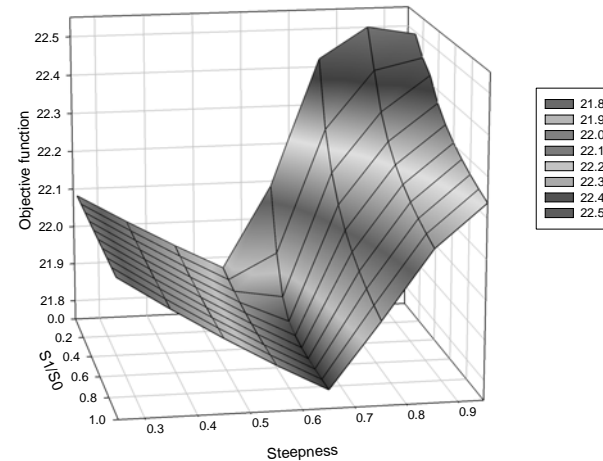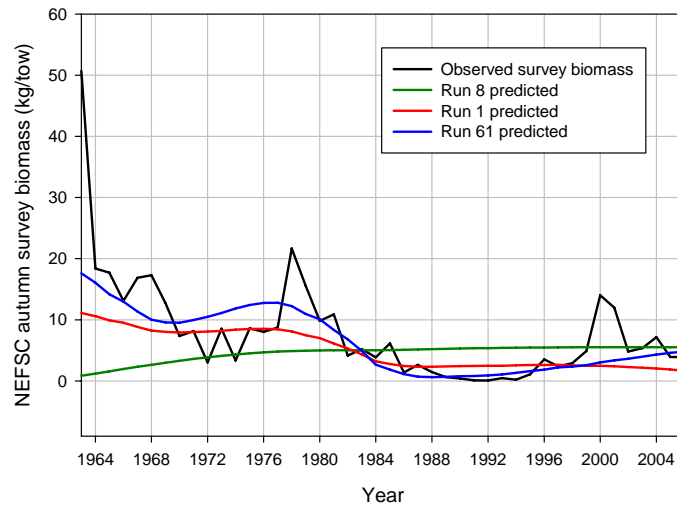
Obj. Function (range: 21.8 – 22.5)
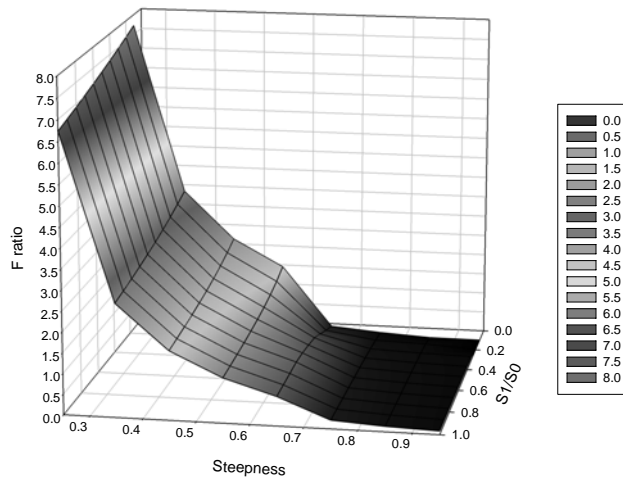
F/F$_{MSY}$ (range: 0.01 – 7.73)
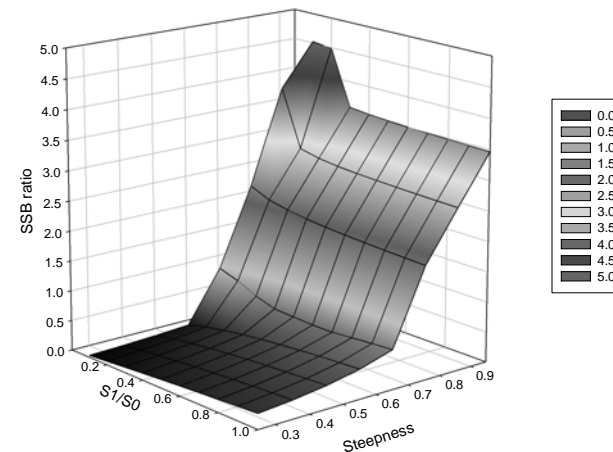
SSB/SSB$_{MSY}$ (range: 0.03 – 4.52)

WP 4.3. The LOSS model – results (cont.)

- Why didn't the model work very well (alternatively, why was it a "loss")?

  - GoM haddock population is driven by non-deterministic recruitment events